Dealing with infectious and parasitic diseases in safari parks, roadside menageries, exotic animal auctions and rehabilitation centres

S.L. PORTER *

Summary: Safari parks, roadside menageries, exotic animal auctions and wildlife rehabilitation centres exist world-wide, and serve as sites of wild animal concentrations. When these animals are brought together, the potential is great for the spread and eventual outbreak of many different infectious and parasitic diseases. It is therefore necessary that procedures be developed in these facilities to minimize the risk of occurrence and spread of these diseases. This will require financial resources for professional personnel, diagnostic testing and appropriate facility design.


INTRODUCTION

While safari parks, roadside menageries, exotic animal auctions and rehabilitation centres all maintain wild animals differently and for varying periods of time, all such facilities need to be concerned with the introduction and spread of infectious and parasitic diseases. In addition, attention needs to be given to the prevention of those diseases which have been shown to be zoonotic. Unfortunately, there is still much to be learned about which species these organisms affect and how they behave in the various species found in these facilities (5, 6).

As economics plays a major role in the operation of all of these facilities, there is a tendency to minimize the attention and resources devoted to basic preventive medicine procedures. In view of the risks involved, and present management practices, it is surprising that so few problems are reported. This may be due to the fact that professional veterinary care is limited in these environments. In the United States of America (USA), all of these facilities are under the jurisdiction of state and Federal laws and regulations regarding wildlife care, but often these are not adequately enforced.

In 1993, a total of 452 roadside menageries, 30 safari parks, and 47 exotic animal auctions were licensed by the United States Department of Agriculture (USDA) (B. Kohn, personal communication). The National Wildlife Rehabilitators’ Association

* Blue Ridge Community College, P.O. Box 80, Weyers Cave, VA 24486, United States of America.
(NWRA) surveyed its 1,007 members in 1992 and estimated that they cared for 290,124 animals and responded to 565,080 telephone calls related to wildlife (12).

**FACILITIES**

No official definitions exist for the various facilities discussed in this chapter. These terms are frequently used, however, and an attempt will be made to define them.

**Safari parks**

A safari park is typically a large facility with large enclosures for the larger species. Often, it is the human visitors and employees who are enclosed (usually in cars, or in trains or monorails) rather than the animals. There is often a large animal population representing fewer species than in the average zoological garden. An area is usually set aside where people may buy refreshments and gifts, and where some species may be viewed in smaller enclosures. Many of these parks have limited veterinary facilities and some do not have a full-time veterinarian. Sick or injured animals may be referred to a local practitioner. Quarantine and hospital facilities are rarely present.

**Roadside menageries**

A roadside menagerie is a private, commercially-run exotic animal collection; the location is determined primarily by the need to attract tourists. These facilities are often small, and operate seasonally depending on their location. Usually, roadside menageries exhibit a smaller number of animals, representing a limited number of species. Veterinary care is usually limited to a local veterinary practitioner who consults on particular problems. The facilities rarely include a quarantine area or hospital for sick or injured animals.

**Exotic animal auctions**

At an exotic animal auction, animals arrive on the day before the sale and leave when they are sold. The larger auctions may last for four to five days, while smaller auctions last for a single day. Many different species may be transported from both within and outside the state, depending on the proscriptions of the sale. In 1993, the 47 USDA-licensed facilities held 74 auctions (B. Kohn, personal communication). The number of facilities and auctions has been increasing annually. Most of the animals are purchased by private citizens.

The animals which are brought into these exotic animal auctions may be carrying infectious or parasitic diseases, or may contract such diseases at the site. As the animals are present on the site only for a day or two, however, clinical signs are rarely observed. A disease problem may become apparent, therefore, only when the animal reaches the final destination. It is here that a preventive medicine programme is needed, to avoid the introduction and/or spread of disease. A 1995 outbreak of canine rabies in Florida was traced back to foxes and coyotes (*Canis latrans*) bought at an auction in Texas (D.R. Jones, personal communication).
Wildlife rehabilitation centres

Wildlife rehabilitation centres range from those found in private homes to large, non-profit facilities which treat several thousand animals each year. These centres typically have few paid staff and operate primarily with volunteers. Some may work only with birds or mammals. Injured and orphaned wildlife animals are brought to these facilities, where they are treated, may be examined by a veterinarian, and are then maintained until judged ready for release. Many rehabilitation centres also have permanent resident animals for education programmes. Most of the work of such centres involves raising orphaned animals during the spring and summer, with the aim of returning the animals to the wild.

These centres are hampered by a lack of funding and by inadequate facilities. The majority of the animals brought in are never seen by a veterinarian, and necropsy is not usually performed on animals which die. Quarantine is rarely implemented. In view of the wide range of infectious and parasitic diseases present in the wild, these facilities are at great risk of experiencing disease outbreaks. Diseases reported include *Baylisascaris* infections in doves (Columbidae), viral fibroma in grey squirrels (*Sciurus carolinensis*), canine distemper in grey foxes (*Urocyon cinereoargentatus*), salmonellosis in white-tailed deer (*Odocoileus virginianus*), and parvoviral enteritis in raccoons (*Procyonidae*). Many other problems occur but are not diagnosed or documented.

**REGULATIONS**

Safari parks, roadside menageries and exotic animal auctions must all be licensed by the USDA, and are subject to regulations under the Animal Welfare Act (AWA) (2). The Act does not require specific preventive medicine programmes, but it does require veterinary care, disinfestation procedures, and specific housing requirements for various mammalian species. While few wildlife rehabilitation centres are covered under the AWA, they are regulated by the Fish and Wildlife Service of the United States Department of the Interior and state wildlife agencies. Some state regulations may address husbandry, housing and veterinary care.

Non-domestic animals which are transported across state lines must be accompanied by a health certificate signed by an accredited veterinarian. For certain susceptible species, documentation of diagnostic testing and/or vaccination is required. Many states require that deer and antelope be tested and found negative for tuberculosis and brucellosis prior to entry.

Facilities which are members of the American Zoo and Aquarium Association (AZA), the NWRA and the International Wildlife Rehabilitation Council (IWRC) have ethical guidelines for wild animal care (3, 4). The AZA quarantine procedures run to eight pages (4).

If a disease is zoonotic, state public health department regulations may also apply (1).
Numerous bacterial, viral, fungal and parasitic diseases affect the hundreds of wildlife species maintained in captive facilities. In many cases, infections are subclinical and may not be evident unless the animal is stressed, which is common in captivity (14). While in the subclinical state, the organism may infect the environment and/or easily spread to other susceptible species. While knowledge of wild animal diseases has increased markedly in the last twenty years, much remains unknown, including which species are susceptible to which pathogens (7). Known diseases are frequently being described in new species (e.g. canine distemper in exotic felids) (5, 6). There is therefore a constant risk of infectious and contagious disease outbreaks, especially when animals are stressed by being brought into captivity or transported from one place to another (14).

Disease outbreaks are often not reported, due to a lack of veterinary support or interest. Diseases which have been documented include *Baylisascaris* infection in doves, squirrel fibroma, bovine tuberculosis in antelope and deer, toxoplasmosis in macropods and primates, avian tuberculosis in waterfowl, canine distemper in raccoons and black-footed ferrets (*Mustela nigripes*), and raccoon parvoviral enteritis (8, 9, 10, 11, 13, 15, 16, 17, 18).

The principles involved in preventing disease outbreaks are similar for domestic and wild animals. Wild animals may create special concerns, due to their susceptibility to stress and the difficulties involved in restraining them. For many dangerous species – such as the large carnivores and ungulates – chemical restraint is often required for routine procedures, such as physical examination and sample collection. Nevertheless, the managers of these facilities should endeavour to establish some type of preventive medicine programme on the basis of sound scientific principles.

As animals arrive at the facility, they should be quarantined in an area away from the rest of the animal population. This prevents newly-arrived animals from introducing new pathogens, and also prevents these stressed animals from coming into contact with resident pathogens. Quarantine also allows new animals to become acclimatized to their new surroundings and gives the staff the opportunity to observe their behaviour. Quarantine areas vary between facilities and are often absent. These facilities need to be adequately designed (appropriate enclosures, non-slip flooring, temperature and humidity control, and sufficient ventilation). The length of quarantine varies, depending on the species and the facility. Primate facilities often use ninety-day quarantine periods.

At some point, new arrivals need to be adequately restrained for examination by veterinary personnel for signs of disease. Depending on the facility, this may occur on arrival or several days after the animals have settled down (as demonstrated by their eating, drinking, and general behaviour). At the time of the examination, samples may be collected to be tested for parasites and infectious diseases, and to establish baseline normal values for the species. Specific disease testing (e.g. for tuberculosis in hoofed animals and primates) and vaccination against diseases in susceptible species (e.g. canine distemper and equine pneumonitis) can also be performed at this time. Some species may be routinely de-wormed for common parasites, in the absence of diagnostic testing. A parasite control programme should be in place, including heartworm prevention for susceptible species (e.g. wild canids and sealions [Otariidae]).
The use of domestic animal vaccines in wildlife species for which the vaccines have not been approved is controversial; such vaccination should only be performed on the advice of the attending veterinarian. Modified live canine distemper vaccines have produced disease in grey foxes, red pandas (*Ailurus fulgens*) and Texas long-tailed weasels (*Mustela frenata*), among other species. Mustelids, procyonids and canids are frequently vaccinated against canine distemper, while exotic felids, procyonids and mustelids are vaccinated against feline panleukopenia.

The basic needs of animals should also be attended to (e.g. a balanced diet, sufficient water intake and social requirements). Isolating a member of a social species may result in the animal being stressed to the point that it becomes anorectic. Many wild birds — including harriers, falcons and great blue herons (*Ardea herodias*) — which are brought into rehabilitation centres will not eat in small cages close to people, but will readily eat in larger, more isolated pens. Animals which become behaviourally anorectic will require forced nutritional support and environmental manipulation. These anorectic animals are prime candidates for stress-related diseases such as aspergillosis.

Captive wild animals should be kept separately from their domestic counterparts and free-ranging wildlife. These other species may readily transmit infectious and parasitic diseases to the captive animals or vice versa. Non-human primates which are susceptible to many human diseases should be kept isolated from the public and from facility workers; the latter should wear latex gloves and face-masks when working near these species. Toxoplasmosis has become a significant problem in outdoor primates and macropods, due to the ingestion of ova shed by infected feral cats.

Some species may carry, asymptptomatically, diseases which are fatal for other species. For example, some conure species carry Pacheco’s disease which is devastating for Amazon parrots, macaws and other psittacines; similarly, squirrel monkeys (*Saimiri spp.*) carry herpesvirus T which causes inclusion body hepatitis in marmosets (*Callithrix spp.*) and owl monkeys (*Aotes trivirgatus*). It is important not to house these ‘carriers’ close to the susceptible species. This will require some research on the part of facility personnel before new species are purchased and housed. Species carrying internal parasites may introduce these into the environment, where they may have devastating effects if they are ingested by other species. This includes ascarids such as *Baylisascaris procyonis* and numerous strongyles.

A systematic programme must be in operation for cleaning and disinfecting the area where the animals are housed. This is more difficult if the animals are housed on grass or gravel but — as a minimum requirement — faeces can be removed daily, which will reduce the parasite load. Certain enclosures may require the ground to be treated or may need to be left vacant for a given period prior to introducing other species. Animal enclosures with concrete floors, or consisting of metal and/or plastic cages, can be more thoroughly cleaned and disinfected. It is also important that the water supply be safe from contamination by the animals, and that drinking areas can be routinely cleaned and disinfected. Any animal which dies during the quarantine period (or even afterwards) should be necropsied to determine the cause of death. Necropsy may be performed by the attending veterinarian, a nearby veterinary school or a state agricultural diagnostic laboratory. In almost all cases, other animals are at risk and, if the disease is contagious, adequate steps should be taken to prevent or limit the spread of the disease. Very often, necropsies are not performed; this can lead to other animals
in the collection becoming affected, leading to costly veterinary treatment and/or death of the animals. Preventive medicine is always much less expensive than diagnosing and treating diseased animals.

HANDLING DISEASE OUTBREAKS

If an animal dies or exhibits clinical signs which may be caused by an infectious disease, this animal and any cage-mates should immediately be isolated from the rest of the animal population. If other animals are at risk, the affected animal may be sacrificed for necropsy and diagnostic testing; if not, appropriate diagnostic testing and treatment of the sick animal should be initiated by the attending veterinarian.

An attempt should be made to identify the causative agent. Appropriate cleaning and disinfection procedures should be performed, including proper disposal of waste and water. Footbaths and footwear cleaning procedures should be used on entering and leaving the enclosure. If the disease is thought to be zoonotic, appropriate protective clothing should be worn and access to the animal area should be limited to essential personnel. In any event, restrictions should be placed on access to the infectious area. The rest of the animal population should be monitored for clinical signs.

RECOMMENDATIONS

All the types of facilities described above risk the introduction of various infectious and parasitic agents from newly-introduced animals and from the native wildlife population. Assuming that an adequate preventive medicine programme is in place for the resident animals, it is equally important to prevent introduction of disease from these external sources. Adequate quarantine, diagnostic testing and facility design are essential in this process. Unfortunately, it is expensive to provide adequate facilities, staff and diagnostic testing, and thus these are often lacking.

Safari parks and roadside menageries are commercial operations, and are therefore generally required to adhere to more stringent standards than rehabilitation centres. Under the Animal Welfare Act (2), the former facilities are required to have both a veterinarian who is responsible for the health of the collection and a written medical plan. This plan should include provisions for preventing the introduction of infectious and parasitic diseases. The plan should be reviewed and the consulting veterinarian interviewed when these facilities are inspected by the USDA veterinarian. In general, movement of animals into these facilities should be at a low level, but a quarantine programme should be instituted for new animals which have not been quarantined and tested at their point of origin. The AZA recommends a minimum thirty-day quarantine period for birds, mammals and reptiles, but even two weeks may be adequate (4).

New arrivals must be examined by a veterinarian, and the necessary diagnostic tests and vaccinations should be performed for susceptible species. Recommended tests include the Coggins test for equine infectious anaemia in equids, as well as tests for tuberculosis and brucellosis in ruminants, and for tuberculosis in primates (20). In addition, faeces of all new arrivals should be tested at least once for the presence of internal parasites, and these animals should be examined for the presence of external
parasites. New arrivals should be kept separate from the resident animals. Necropsy should be performed on any animals which die, and if an infectious disease is confirmed, the quarantine period should be extended. In some disease outbreaks (e.g. viscerotropic Newcastle disease or Johne's disease), it may be necessary to destroy all quarantined animals.

It is also important to limit the access of native wildlife to the resident collection. Wild birds, feral cats and rodents are common invaders of wild animal collections and, in addition to predation, these species often transmit various diseases (including leptospirosis, rabies, toxoplasmosis and salmonellosis) to resident animals. Controlling this access – through proper enclosures and pest control programmes – is an important part of the disease prevention process. Insects (e.g. flies and mosquitoes) may also spread diseases such as dirofilariosis and equine encephalomyelitis. An insect control programme is also important, especially in warmer climates where these pests and diseases are more frequently encountered. Ticks are involved in the transmission of many diseases (including babesiosis, chrllichiosis and borreliosis), and therefore tick control is also very important in areas where animals are exposed to these parasites.

Exotic animal auction sites may be a point source for the spread of disease agents over great distances, but as the animals spend so little time at these facilities, it is essential that procedures be implemented which minimize the possibility of infected animals being transported to these auction sites. This essentially requires quarantine, examination, diagnostic testing and vaccination at the point of origin, together with the proper paperwork to substantiate that these procedures have been performed. Animals should be at least casually inspected by a veterinarian at the auction site, and necropsies should be performed on any animals which die. The auction facility should be designed so that contact between the various species may be avoided, and adequate cleaning and disinfection can be accomplished. Despite all these precautions, the introduction of diseases will not be totally prevented, but it can be minimized. Those purchasing exotic animals at auction should be made aware of the common diseases which occur in these species, and of any risk posed to their resident collections.

There is enormous variation in the facilities, staff, resources, and the number and variety of species present in rehabilitation centres. Most centres are located in individual homes. Unfortunately, these rehabilitation centres are often presented with hundreds or even thousands of animals over very short periods of time. Most animals are young and initially take up little space, but ultimately their space requirements increase. Most rehabilitation centres require that incoming animals be examined for signs of disease, but these examinations are rarely performed by veterinarians or other adequately-trained persons. Quarantine, if it occurs at all, is limited to a separate cage or pen for the new arrival. Due to space limitations, large numbers of the same species are often housed together, and this has led to outbreaks of scabies in foxes, viral fibroma in grey squirrels, *Baylisascaris* encephalomyelitis in various species, distemper in grey foxes, and salmonellosis in white-tailed deer.

Rehabilitation centres need to expand to include a quarantine area, and should at least keep individual unrelated animals separate for two weeks. At the same time, faecal examination should be performed on new arrivals, and adequate de-worming treatment should be given to infected animals. A large number of the animals which enter rehabilitation centres subsequently die at the facility, and the opportunity therefore exists for disease monitoring. Unfortunately, this is often not accomplished due to limited time, funds and training. Rehabilitators also need to be concerned about
the translocation of infected animals (19). This is particularly important during epizootics, such as the raccoon rabies situation in the north-eastern USA and the canine rabies outbreak in Texas. Only healthy animals should be released, and then only for return to the area where they were initially found or to another suitable habitat nearby.

In areas experiencing a rabies epizootic, facilities which accept high-risk rabies vectors (such as raccoons, skunks, foxes and bats) should develop policies whereby the only personnel which handle these species have pre-exposure rabies vaccination. The public should also be advised about the risk of rabies infection associated with handling these species. If any mammal exhibits signs consistent with rabies, the animal should be euthanized and the brain should be submitted to a laboratory for testing.

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LE PROBLÈME DES MALADIES INFECTIEUSES ET PARASITAIRES DANS LES PARCS DE VISION, LES MÈNAGERIES, LES VENTES PUBLIQUES D’ANIMAUX EXOTIQUES ET LES CENTRES DE RÉHABILITATION. - S.L. Porter.

Résumé : Les parcs de vision, les ménageries en bordure de route, les ventes publiques d’animaux exotiques et les centres de réhabilitation d’animaux sauvages, qui existent partout dans le monde, sont autant de sites destinés à accueillir une grande concentration d’animaux sauvages. Ces rassemblements d’animaux augmentent les risques de propagation de maladies et d’apparition d’épidémies infectieuses et parasitaires. Des méthodes doivent donc être mises au point dans ces sites afin de réduire ces risques. Ces mesures supposent que l’on dispose des ressources financières nécessaires au recrutement d’un personnel qualifié, à la réalisation d’épreuves diagnostiques et à l’aménagement de locaux adaptés.

MOTS-CLÉS : Foyers infectieux - Médecine préventive - Ménageries - Parcs de vision - Réhabilitation de la faune sauvage - Ventes publiques d’animaux exotiques.

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Resumen: Los parques de safari, las colecciones de fieras al borde de carreteras, las subastas de animales exóticos y los centros de recuperación de la fauna salvaje existen en el mundo entero, y constituyen espacios en los que se concentran gran número de animales salvajes. Esta concentración de animales distintos eleva las probabilidades de propagación y eventuales brotes de numerosas y variadas enfermedades infecciosas y parasitarias. Por consiguiente, es necesario desarrollar los procedimientos que minimizan los riesgos de ocurrencia y de propagación de estas enfermedades en dichos
lugares. Esto a su vez supone recursos económicos suficientes para contratar personal cualificado, realizar pruebas de diagnóstico y diseñar instalaciones adecuadas.


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REFERENCES


